NAME: AMAO MUHAMMED OLAMIDE

MATRIC NUMBER: 17/SCI01/015

COURSE CODE: CSC304

COURSE TITLE: Theory of Computing

Revision 2

1. Design Regular expression for the following Languages:
2. Language whose length is at most 2
3. Language of even length
4. Language starting and ending with the same letter.
5. Language starting and ending with the different letter
6. What is regular expression? Highlights identities of regular expression.
7. Let A be a nonempty alphabet, define the expression r and its corresponding language L(r). State the five symbols that are used for regular expression.
8. Let A = {a, b}. Describe each of the following regular expression r and its corresponding language L(r).
9. Let r=b^\*
10. Let 〖r=aa〗^\*
11. Let 〖r=a∪b〗^\*
12. Let r=(a∪〖b)〗^\*
13. Let r=aa(a∪〖b)〗^\*
14. Let r=(a〖∩b)〗^\*
15. Consider the following languages over ∑={a,b}. L\_1={b^m a^n |m>0,n>1} L\_2= {a^n b^m a|m>1,n>0} and L\_3={ab^n| n>0}.

Find a regular expression r over A = {a.b} such that L L\_i= L(r) ∀ i=1,2,3

1. What is a regular set?

Describe the set represented by R as denoted by L(R). For example- Let R1 and R2 denote any two regular expressions. Then: A string in L (R1 + R2) is a string from R1 or a string from R2

1. Describe the following sets by regular expression i. {110} ii. {baab} iii. {01,10} iv. {ε,10} v. {abb,a,b,bba} vi. {ε,a,aa,aaa,…} vii. {1,11,111,…}
2. Describe the following set by regular expressions:
3. L\_1 is the set of all strings of a’s and b’s ending in aa
4. L\_2 is the set of all strings of 0’s and 1’s beginning with 1 and ending with 0.

iii. L\_3 is the set of {ε,11,1111,11111,…}

1. Define Grammar. Differentiate between Grammar and Language.

24. Describe the sentential derivation of strings in grammar. Use a given example to justify this.

SOLN

15.

1. L={λ,a,b,aa,ab,ba,bb}

L(r)=(λ+a+b)(λ+a+b)

1. L={λ,aa,ab,ba,bb,…}

L(r)=((a+b)(a+b))\*

1. L={λ,a,b,aa,aba,bab,…}

L(r)=(a(a+b)\*a + b(a+b)\*b + a +b + λ )

1. L={ab,ba,baa,aab,…}

L(r)=(a(a+b)\*b+ b(a+b)\*a )

16. Regular expression: Regular expressions can be thought of as the algebraic description of a regular language. Regular expression can be defined by the following rules: Every letter of the alphabet ∑ is a regular expression. Null string є and empty set Ø are regular expressions.

Regular expression identities

1. L + M = M + L

2. (L + M) + N = L + (M + N)

3. (LM)N = L(MN)

4. Ø+ L = L + Ø = L

5. ?L = L? = L

6. ØL = LØ = Ø

7. L(M + N) = LM + LN

8. (M + N)L = ML + NL

9. L + L = L

10. (L\*)\*= L\*

11. Ø\*= ?

12. ?\*= ?

13. (xy)\*x = x(yx)\*

14. The following are all equivalent:

(a) (x + y)\*

(b) (x\*+ y)\*

(c) x\*(x + y)\*

(d) (x + yx\*)\*

(e) (x\*y\*)\*

(f) x\*(yx\*)\*

17. Symbols used in regular expression

* Union (∪) also represented as +,
* Lambda or epsilon (λ,ε)
* asterich (\*) ,
* Right hand bracket [ )]
* Left hand bracket [ ( ]

18.let A={a,b}

1. Let r=b\* : this language consists of all powers of b including the empty word λ, l(r)={λ,b,bb,bbb,…}
2. Let r = (aa)\* :this language consist of all powers of a concatenated to a including the empty string λ. l(r)={λ,aa,aaaa,aaaaaa,…}
3. Let r = (a∪b)\* : this language consist of all words over the alphabet A including the empty word λ. l(r)={λ,a,b,aa,ab,ba,bb,…}
4. Let r = a∪(b)\* : this language consist of a or any word in b.
5. Let r = aa(a∪(b)\*): This language consists of words beginning with aa followed by a or any word in b.
6. Let r = a∩(b)\* : This language consist of words beginning with a concatenated with words in b.

19.

1. L1 = bman|m>0,n>1

Lr=bb\*aaa\*

L(Lr) = {baa, bbaa, bbaaa, …}

1. L2 = anbma|m>1,n>0

Lr=aa\*bbb\*a

L(Lr) = {abba, aabba, aabbba, …}

1. L3 = abm|m>0

Lr=(ab)(ab)\*

L(Lr) = {ab, abab, ababab, …}

1. A set represented by a regular expression is called a regular set.
2. {1}{0} represented by 1, and 0 respectively. Therefore 110 is gotten by concatenating 1, 1, and 0.
3. The set {a,b} represented by a,b. the word baab is gotten by concatenating b, a, a, and b.
4. The set {01,10} is gotten from the union of {01} and {10}, then we have 01+10.
5. The set {ε,10} is gotten by the union of the empty word epsilon and the concatenation of 1 and 0, ε+10.
6. The set {abb, a, b, bba} on the language ∑ ={a,b} is represented as the union of the concatenation of a,b,b with a , with b and with the concatenation of b, b, a. then we have abb + a + b + bba
7. The set {ε,a, aa, aaa,…} represented as {a}\* the R.E is a\*.
8. {1,11,111,1111,…}represented set {1}\* R.E for this set is 1(1)\*
9. Set of all srings of a’s and b’s ending with aa

r=(a+b)\*aa

L(r)={aa, aaa, baa,…}

1. Set of all strings of o’s and 1’s starting with 1 and ending with 0’s

r=(1(1+0)\*0)

L(r)={10,110,100,1000,…}

1. Set of all powers of 11 including the empty word

r=((11)\*)

L(r)={ε,11,1111,111111,…}

1. Grammars are finite set of rules used to describe languages, it is used to generate a language.While Language is a set of strings generated by grammar.
2. Derivation of Strings in Grammar:

V: Variable-set of finite objects represented in upper case

T: Terminal-set of finite objects represented in lower case

S: Starting symbol- from here we derive the other strings

P: Production rule-finite set of rules followed to generate strings

Let G=(V,T,S,P) be a grammar, the set l(G)={w∈ T\*:S→\*w} is the language generated by G. if w∈L(G) the sequence S→w1→w2→…→wn is a derivation of the sentence w. the string S→w1→w2→…→wn→w, which contains variables as well as terminals is called “sentential form of derivation”.

ii) G=({S},{a,b},S,P)

P: S→aSb|λ

S→λ

S→aSb→aλb→ab

S→aSb→aaSbb→aaλbb→aabb

L(G)={λ,ab,aabb,aaabbb,…}